Annals of Clinical and Analytical Medicine
Original Research

Evaluation of depression and sleep quality in geriatric patients with spinal cord injury

Depression and sleep in geriatric spinal cord injury

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This study was presented as an oral presentation at the Bone and Joint 9th Medical Rehabilitation Congress, Antalya, Turkiye, 2024

Abstract

Aim: Depression and sleep disturbances are common, challenging conditions in geriatric patients with spinal cord injury. Although both conditions are treatable, they are usually overlooked and understudied. This study aims to investigate depression, sleep disturbance, and related factors in geriatric patients with spinal cord injury.

Material and Methods: This prospective descriptive study included 69 consecutive patients with spinal cord injury who were admitted to a tertiary care center in Turkey. Demographic and clinical data were noted, including each patient's cause of injury and impairment status. The presence of depression, presence of sleep disturbance, daytime sleepiness, presence of neuropathic pain, functional independence and comorbidities were assessed using the Geriatric Depression Scale, Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Douleur Neuropathic 4 Questions questionnaire, Barthel Index, and Charlson Comorbidity Index, respectively. Prevalence and association of depression, sleep disorders, and neuropathic pain with each other and with other demographic and clinical parameters were examined.

Results: In our study, over 90% of patients had sleep disturbance, and 20.1% had moderate or definite depression. Patients with depression had higher sleep disturbance scores, and patients with sleep disturbance had higher depression scores ($p=0.001$, $p=0.002$). Both patients with depression and patients with sleep disturbance had higher daytime sleepiness scores ($p=0.005$, $p<0.001$). Patients with sleep disturbance had a significantly higher frequency of neuropathic pain ($p=0.005$).

Discussion: Depression and sleep disturbance are common in geriatric patients with spinal cord injury and are associated with each other, increased daytime sleepiness and neuropathic pain. Thus, the presence of sleep disturbances and depression should be evaluated in every geriatric patient with spinal cord injury. Further, rehabilitative management of these patients should include psychiatric evaluation and interventions.

Keywords
Depression, Sleep Quality, Spinal Cord Injury

DOI: 10.4328/ACAM.22402 Received: 2024-09-15 Accepted: 2024-11-04 Published Online: 2024-11-13 Printed: 2024-12-01 Ann Clin Anal Med 2024;15(12):881-887

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This study was approved by the Ethics Committee of Ankara Bilkent City Hospital (Date: 2022-10-26, No: E2-22-2660)

Introduction

Depression and sleep disorders, for which advanced age and poor general health are risk factors, are more frequently seen in patients with spinal cord injury (SCI) than in the general population [1- 3]. Both depression and sleep disorders interact with each other and negatively affect the quality of life of patients.

In the meta-analysis published by Williams and Mury in 2015, the mean estimated prevalence of depression diagnosis after SCI was reported as 22.2% [3]. However, there are few studies investigating depression and related factors in the elderly SCI group. In a previous study published in Sweden, which included patients 50 years of age and older with a reported SCI for at least ten years, the prevalence of depression was found to be 29%. In this study, the presence of neuropathic pain, bladder and bowel problems, not having a job, and a low ability to cope with the disease were found to be associated with depression [2]. Most of these factors are preventable or treatable. The fact that the scales used in depression screenings are different and the socio-cultural structures of the countries are variable also affects the frequency of depression and related factors.

In a relatively small number of studies investigating sleep disorders in patients with SCI, sleep disorders were found to be associated with a high level of injury, pain, disruption of circadian rhythm, fatigue, and increased daytime sleepiness [1]. Further, increased daytime sleepiness, depression, and fatigue also negatively affect the patient's participation in the rehabilitation program during the day [4].

Our study's objective is to examine depression, sleep disturbances, and associated factors in geriatric patients with SCI. Our literature search did not find similar studies involving this patient group. Thus, we think that the results of our study will be enlightening for physicians dealing with this fragile patient group and will contribute to future studies on these issues.

Material and Methods

Geriatric patients aged 65 and older with SCI were selected from consecutive attendees of the Physical Medicine and Rehabilitation Clinic. Information about the study was given to all participants, and they provided written informed consent before enrolling. The inclusion criteria were: 1) disabling sequelae resulting from SCI; 2) age of 65 years or older; and 3) cooperative. Patients were excluded based on the following criteria: 1) the presence of an additional neurological disease, 2) cognitive impairment, 3) an unstable condition.

Demographic and clinical characteristics of the patients, including gender, age, education status, marital status, primary caregiver, cause of injury, time since injury, impairment status (tetraplegic/ paraplegic), incompleteness/completeness of injury based on the American Spinal Injury Association (ASIA) Impairment Scale, bladder and bowel control, presence of neuropathic pain, and presence of decubitus ulcer were recorded. Patients were categorized based on the ASIA Impairment Scale (AIS), as revised in the 2011 International Standards for Neurological Classification of Spinal Cord Injury [5]. For patients with non-traumatic SCI, the onset of neurological symptoms was used to determine the time since injury.

Depression presence was determined using the Turkish version of the Geriatric Depression Scale (GDS) [6, 7]. A GDS score ranging from 0 to 10 points was considered as no depression, 11 to 13 points as moderate depression, and 14 points or more as definite depression.

Quality of sleep was evaluated using the Turkish version of the Pittsburgh Sleep Quality Index (PSQI) [8, 9]. This 19-item scale assesses seven components of sleep quality: subjective sleep quality, sleep duration, sleep latency, sleep disturbances, habitual sleep efficiency, use of sleep medication, and daytime dysfunction over the past month. Global sleep disturbance scores higher than 5 indicate clinically significant sleep disturbance. The PSQI is a valid and reliable instrument that has previously been used to assess sleep quality in geriatric patients [10].

Day-time sleepiness was evaluated using the Turkish version of the Epworth Sleepiness Scale [11, 12]. This scale consists of 8 questions relating to situations in everyday life. Participants are asked to rate the likelihood of dozing off or falling asleep in these situations. The scoring is as follows: 0 = no chance of dozing off, 1 = low chance of dozing off, 2 = medium chance of dozing off, and 3 = high chance of dozing off. The total score, ranging from 0 to 24, is obtained by summing the scores for each question. Higher scores indicate a greater degree of daytime sleepiness.

Neuropathic pain presence was evaluated using the Turkish-validated version of the Douleur Neuropathic 4 Questions (DN4) questionnaire [13]. The DN4 includes sensory descriptors and signs associated with bedside sensory examination [14]. Patients with DN4 scores equal to or higher than four were considered to have neuropathic pain.

The Turkish-validated form of the Barthel index (BI) was used to evaluate functional independence [15]. The BI is used to assess the subject's functional ability to carry out activities of daily living (ADLs). This index includes ten items related to mobility that make up the ADLs: bathing, dressing, feeding, grooming, transfers from bed to chair and back, toilet use, bladder and bowel control, mobility, and stair climbing. Each item is assigned a score of 0, 5, 10, or 15 based on the individual's capability to carry out the activity. The total score ranges from 0 to 100 points.

The Charlson comorbidity index was utilized to assess general comorbid conditions [16]. This index considers both the number and severity of comorbid conditions. Each of the following conditions is assigned a score of "1": congestive heart failure, myocardial infarction, chronic pulmonary disease, peripheral vascular disease, dementia, ulcer disease, connective tissue disease, mild liver disease, and diabetes. Hemiplegia, moderate to severe renal disease, tumors, diabetes with end-stage organ damage, lymphoma, and leukemia are each given a score of "2". Moderate to severe liver diseases are scored as "3", and AIDS and metastatic solid tumors are each scored as "6".

Statistical Analysis

Initially, all data were classified as continuous and categorical variables. Percentages of categorical data were determined. Distribution characteristics of continuous variables were determined [(median, standard error, mean, standard deviation, and 25%-75% interquartile range (IQR)]. The Mann-Whitney U test was used to determine whether a statistically significant difference existed for continuous variables that were not normally distributed. The x2 test was used for categorical comparisons. The Student's t-test was used to compare normally distributed continuous variables. P value < 0.05 was considered statistically significant. Statistical analyses were conducted using SPSS version 25.0 software (SPSS Inc., Chicago, IL, USA).

Ethical Approval

This study was performed in accordance with the tenets of the Declaration of Helsinki, and ethical approval was obtained from the local committee.This study was approved by the Ethics Committee of Ankara Bilkent City Hospital (Date: 2022-10-26, No: E2-22-2660).

Results

A total of 69 geriatric patients with SCI were enrolled in this study. The study group comprised 28 (40.6%) women and 41 (59.4%) men with a mean age of 70±4 years. The mean time since injury was 36±54 months.

The majority of patients participating in the study were married (78.3%). Only 2 (2.9%) of the patients did not need a caregiver, and the primary caregiver for nearly half of the participants (49.3%) was their wife/husband. More than half of the patients only had primary school education (69.6%). The most common cause of SCI was falls (29%), followed by spinal stenosis and discopathies (21.7%). From the total number of patients, 72.5% had paraplegia, 27.5% had tetraplegia, 84.1% had incomplete lesions, and 15.9% had complete lesions. Further, 60.9% of patients had urinary incontinence, with 17.4% of them using intermittent urinary catheters and nearly half (44.9%) using permanent urinary catheters. Additionally, 44.9% of patients had fecal incontinence, 11.6% had a decubitus ulcer, and 79.7% had neuropathic pain. Patients' mean Charlson comorbidity scores and Barthel index scores were 4±1 and 43±22, respectively. More than 90% of the patients experienced sleep disturbances, and 20.1% were found to have moderate or definite depression. Patients' demographic and clinical characteristics are presented in Table 1.

There were no differences between participants with and without depression in terms of age, gender, education status, mean time since injury, impairment status, completeness of SCI, presence of urinary incontinence, presence of fecal incontinence, presence of decubitus ulcer, presence of neuropathic pain, mean Charlson comorbidity index score, and mean Barthel index score (p=0.808, p=0.597, p=0.409, p=0.534, p=0.262, p=0.614, p=0.339, p=1.000, p=1.000, p=0.230, p=0.784, p=0.849, respectively). All patients with depression were married, and 72.7% of patients without depression were married (p=0.036). Patients with depression had significantly higher PSQI scores and Epworth Sleepiness Scores (p= 0.001, p= 0.005). All patients with depression had sleep disturbances, and 90.9% of patients without depression also had sleep disturbances. However, the difference between the two groups was not statistically significant (p=0.590). Table 2 shows a comparison of patients with and without depression.

There were no differences between participants with and without sleep disturbance in terms of age, gender, marital status, impairment status, completeness of injury, presence of urinary incontinence, presence of fecal incontinence, presence of decubitus ulcer, mean Charlson comorbidity index score and mean Barthel index score (p=0.909, p=0.389, p=0.277, p=0.611, p=0.177, p=1.000, p= 0.370, p=0.471, p=0.229, p=332, respectively). Patients with sleep disturbance had

Table 1. Demographic and Clinical Characteristics of Patients

Demographic and clinical characteristics	
Age (years) *	70±4
Gender	
Female, n (%)	28 (40.6)
Male, n (%)	41 (59.4)
Education Status	
Primary School, n (%)	48 (69.6)
High School, n (%)	17 (24.6)
University, n (%)	4 (5.8)
Marital Status	
Married, n (%)	54 (78.3)
Single, n (%)	15 (21.7)
Primary care-giver	
Spouse (husband/wife), n (%)	34 (49.3)
First degree relative, n (%)	27 (39.1)
Payed care-giver, n (%)	6 (8.6)
Absent, n (%)	2 (2.9)
Cause of Spinal Cord Injury	
Falls, n (%)	20 (29)
Spinal stenosis and discopathies, n (%)	15 (21.7)
Tumor, n (%)	8 (11.6)
Motor vehicle accident, n (%)	6 (8.7)
Aort dissection, n (%)	4 (5.8)
Transverse myelitis, n (%)	3 (4.3)
Other (arteriovenous fistula, spinal cord infection, syringomyelia), n (%)	13 (18.8)
Impairment Status	
Paraplegia, n (%)	50 (72.5)
Tetraplegia, n (%)	19 (27.5)
Time since injury (months) *	36±54
AIS level on admission	
AIS A, n (%)	11 (15.9)
AIS B, n (%)	13 (18.4)
AIS C, n (%)	12 (17.4)
AIS D, n (%)	34 (49.3)
Completeness of injury	
Complete, n (%)	11 (15.9)
Incomplete, n (%)	58 (84.1)
Urinary incontinence, n (%)	42 (60.9)
Urinating pattern	
Intermittant catheterization, n (%)	31 (44.9)
Spontaneous urination, n (%)	26 (37.7)
Permanent urinary catheter, n (%)	12 (17.4)
Fecal incontinence, n (%)	31 (44.9)
Decubitus ulcer, n (%)	8 (11.6)
Neuropathic pain, n (%)	55 (79.7)
Charlson comorbidity index score*	4±1
Epworth sleepiness scale score*	9±4
Barthel index score*	43±22
Moderate or definite depression, n (%)	14 (20.1)
Sleep disturbance, n (%)	64 (92.7)

AIS: Asia Impairment Scale, *, mean±SD

Table 2. Comparison of Patients with and without Depression

	Patients with depression (n=14, 20.1%)	Patients without depression (n=55, 79.9%)	p-value
Age (years) *	70±4	70±5	0.808
Gender			
Female, n (%)	7 (50)	21 (38.2)	0.597
Male, n (%)	7 (50)	34,(61.8)	
Education Status			
Primary School, n (%)	10 (71.4)	38 (69.1)	0.409
High School, n (%)	4 (28.6)	13 (23.6)	
University, n (%)	0 (0)	4 (7.3)	
Marital Status			
Married, n (%)	14 (100)	40 (72.7)	0.036
Single, n (%)	0 (0)	15 (28.3)	
Cause of Spinal Cord Injury			
Falls, n (%)	4 (28.6)	16 (29.1)	0.931
Spinal stenosis and discopathies, n (%)	2 (14.3)	13 (23.7)	
Tumor, n (%)	1 (7.1)	7 (12.7)	
Motor vehicle accident, n (%)	1 (7.1)	5 (9.1)	
Aort dissection, n (%)	1 (7.1)	3 (5.5)	
Transverse myelitis, n (%)	2 (14.3)	1 (1.8)	
Other (arteriovenous fistula, spinal cord infection, syringomyelia), n (%)	3 (21.4)	10 (18.2)	
Impairment Status			
Paraplegia, n (%)	12 (85.7)	38 (69.1)	0.262
Tetraplegia, n (%)	2 (14.3)	17 (30.9)	
Time since injury (months) *	45±57	35±54	0.534
Completeness of injury			
Complete, n (%)	1 (7.1)	10 (18.2)	0.614
Incomplete, n (%)	13 (92.9)	45 (81.8)	
Urinary incontinence, n (%)	7 (50)	35 (63.6)	0.399
Urinating pattern			
Intermittant catheterization, n (%)	5, (35.7)	26 (47.3)	0.890
Spontaneous urination, n (%)	6, (42.9)	20 (36.4)	
Permanent urinary catheter, n (%)	3, (21.4)	9 (16.4)	
Fecal incontinence, n (%)	6, (42.9)	25, (45.5)	1.000
Decubitus ulcer, n (%)	2, (14.3)	6, (10.9)	1.000
Neuropathic pain, n (%)	10, (71.4)	45 (81.8)	0.230
Charlson comorbidity index score*	4±2	4±1	0.784
Epworth sleepiness scale score *	11±3	8±4	0.005
Barthel index score *	41±25	42±22	0.849
PSQI score *	15±3	10±4	0.001

PSQI: Pittsburgh Sleep Quality Index, * mean±SD

significantly lower education levels and significantly higher frequency of neuropathic pain (p=0.001, p=0.005). Also, GDS scores and ESS scores were significantly higher in patients with sleep disturbance than in patients without sleep disturbance (p=0.002, p<0.001). None of the patients without sleep disturbance had depression, and 21.9% of the patients with sleep disturbance had depression. However, such a difference did not reach statistical significance (p=0.575). Table 3 shows a comparison of patients with and without sleep disturbance.

Discussion

In our study, over 90% of patients had sleep disturbance, and 21.4% had moderate or definite depression. Patients with depression had higher PSQI scores, and patients with sleep disturbance had higher GDS scores. Both patients with depression and patients with sleep disturbance had significantly higher ESS scores. Patients with sleep disturbance had a significantly higher frequency of neuropathic pain.

Many people with SCI live to an advanced age. A thorough understanding of the factors associated with healthy aging is therefore essential. As mental health is a critical component of healthy aging, the psychological challenges associated with living with SCI in the geriatric population warrant greater attention.

Depression is a prevalent psychological condition in the geriatric population, and the likelihood of developing this condition has been shown to rise following SCI [3, 7, 17]. In our study, 20.1% of geriatric patients with SCI had depression. Depressive symptoms following SCI are thought to be more closely associated with psychological factors and behaviors

Table 3. Comparison of Patients with and without Sleep Disturbance

	Patients with sleep disturbance (n=64, 92.7%)	Patients without sleep disturbance (n=5, 7.3%)	p-value
Age (years) *	70 (5)	71 (4)	0.909
Gender			
Female, n (%)	25 (39.1)	3 (60)	0.389
Male, n (%)	39 (60.9)	2 (40)	
Education Status			
Primary School, n (%)	47 (73.4)	1 (20)	0.001
High School, n (%)	15 (23.4)	2 (40)	
University, n (%)	2 (3.1)	2 (40)	
Marital Status			
Married, n (%)	51 (79.7)	3 (60)	0.277
Single, n (%)	13 (21.3)	2 (40)	
Cause of Spinal Cord Injury			
Falls, n (%)	17 (26.6)	3 (60)	0.789
Spinal stenosis and discopathies, n (%)	15 (23.4)	0 (0)	
Tumor, n (%)	8 (12.5)	0 (0)	
Motor vehicle accident, n (%)	6 (9.4)	0 (0)	
Aort dissection, n (%)	35 (41.7)	0 (0)	
Transverse myelitis, n (%)	49 (58.3)	0 (0)	
Other (arteriovenous fistula, spinal cord infection, syringomyelia), n (%)	11 (17.2)	2 (40)	
Impairment Status			
Paraplejia, n (%)	47 (73.4)	3 (60)	0.611
Tetraplegia, n (%)	17 (26.6)	2 (40)	
Time since injury (months) *	38±56	13±13	0.311
Completeness of injury			
Complete, n (%)	9 (14.1)	2 (40)	0.177
Incomplete, n (%)	55 (85.9)	3 (60)	
Urinary incontinence, n (%)	39 (60.9)	3 (60)	1.000
Urinating pattern			
Intermittant catheterization, n (%)	29 (45.3)	2 (40)	0.993
Spontaneous urination, n (%)	24 (37.5)	2 (40)	
Permanent urinary catheter, n (%)	11 (17.2)	1 (20)	
Fecal incontinence, n (%)	30 (46.9)	1 (20)	0.370
Decubitus ulcer, n (%)	7 (10.9)	1 (20)	0.471
Neuropathic pain, n (%)	54 (84.4)	1 (20)	0.005
Charlson comorbidity index score *	4±1	3±2	0.229
Epworth sleepiness scale score *	9±4	2±3	<0.001
Barthel index score *	42±22	52±28	0.332
GDS score *	8±3	4±3	0.002

GDS: Geriatric Depression Scale Score, * mean±SD

than with socio-demographic elements such as age and gender or with injury specifics such as the level and severity of injury [18, 19]. In line with these findings, in our study, depression was not associated with age, gender, cause of SCI, education status, time since injury, impairment status, comorbidities, and functional independence.

In contrast to previous studies, depression was more common among geriatric married patients with SCI than single ones [2, 19]. Further, in nearly 50% of the cases, the primary caregiver was the patient's husband/wife. Patients may have more difficulties in adjusting to a life with disabilities due to the thought of being a burden for their spouse, which may, in turn, lead to depression.

In our study, we found that higher scores on the daytime sleepiness scale and higher scores in PSQI were associated with depression. Similarly, in a study investigating depressive symptoms among older adults with SCI, psychological resources, pain, and participation in physical activity were the strongest explanatory factors for depressive symptoms [2]. Depression, increased daytime sleepiness, and sleep disturbances all negatively affect quality of life and rehabilitation outcomes. Overall, all these results imply that mental health among geriatric patients with SCI should be supported through rehabilitation that strengthens their ability to manage life stressors, provides pain management, encourages participation, and promotes acceptance of the injury in social life and physical activity.

Sleep disturbance is another common but usually underdiagnosed comorbidity in SCI. In a study published in Turkey, 74.7% of the patients with SCI had subjective sleep disturbances [20]. Conti et al. reported that 43.8% of the patients with SCI had poor sleep quality [4]. Both studies used PSQI to detect sleep disturbance. In this study, we used the same scale for the detection of sleep disturbance, although in our case, only geriatric patients with SCI were included. The frequency of sleep disturbance was very high in our study. This outcome may be due to the higher incidence of sleep disturbances in older adults, as aging is linked to a rise in psychosocial factors impacting sleep, multimorbidity, polypharmacy, and specific primary sleep disorders [10, 21].

Sleep disturbance was not associated with age, gender, cause of SCI, marital status, time since injury, higher comorbidities, and functional independence in our study. Similarly, in the study by Aydın et al., sleep disturbance was not associated with age, gender, time since injury, and functional independence [20]. Indeed, in our study, the only demographic factor affecting sleep disturbance was education status. Patients with higher education status had less sleep disturbance. This may be because this group of patients can develop stronger disease coping strategies and, therefore, can also have better sleep quality.

In our study, paraplegic and tetraplegic patients had a similar frequency of sleep disturbance. Sankari et al. reported more severe sleep-disordered breathing in tetraplegic patients compared with paraplegics [1]. Tetraplegic patients, especially those with diaphragmatic dysfunction, may be at risk of nocturnal hypoxia. However, in two studies assessing general sleep quality with PSQI, sleep disturbance was more common in tetraplegics in one study and paraplegics in another study [20, 22]. Participants in our study had a very high frequency of sleep disturbance independent of impairment status. Underlying problems like comorbid diseases and physiological changes in aging, such as a decrease in total sleep time, fragmented sleep, reduction in stage 3 non-rapid eye movement phase, change in circadian phase, and increased daytime naps may have contributed to our results [23].

In our study, higher GDS and neuropathic pain scores were associated with sleep disturbance, which is in line with previous literature [24]. Also, patients with sleep disturbance had higher daytime sleepiness. In a USA-based study, late-life anxiety and depression were found to be associated with subjective sleep disturbance in older adults. The findings of this study suggest that subjective assessments of sleep quality and daytime sleepiness are more indicative of subthreshold psychiatric symptoms than objective sleep biomarkers [25]. Sufficient and refreshing sleep is important for good health, physical and cognitive. Thus, we believe that all these pathologies should be together evaluated and treated in rehabilitation settings. Sleep disturbance in geriatric patients with SCI is a multifactorial health condition, necessitating a multi-faceted treatment approach.

Strengths

To our knowledge, this is the first research that simultaneously assesses depression, sleep quality, and related factors in geriatric patients with SCI. We included geriatric patients with SCI, an under-represented group in rehabilitation research. Patients were selected carefully using strict exclusion criteria to create a homogenous study group. The study's general findings and results may be helpful for health professionals working with geriatric patients with SCI and could provide insights for future research.

Limitation

This study has several limitations. Firstly, the study's cross-sectional design did not permit the evaluation of the temporal relationship between variables. Secondly, subjective data may be self-reported. Finally, some limitations may have been caused by the potential for confounding factors that were not controlled.

Conclusion

Our study gives important clues for a general approach to geriatric patients with SCI. Both depression and sleep disturbances are common and treatable disorders that negatively affect the healthy aging of geriatric patients with SCI. Thus, these comorbidities should be routinely screened and treated when detected. SCI research includes mostly younger and middle-aged persons, and there is a great need for new studies investigating psychosocial problems and associated factors in geriatric patients with SCI.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

Funding: *None*

Conflict of Interest
The authors declare that there is no conflict of interest.

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How to cite this article:
Gul Mete Civelek, Handan Elif Nur Bayraktar, Zeynep Keskin. *Evaluation of depression and sleep quality in geriatric patients with spinal cord injury. Ann Clin Anal Med 2024;15(12):881-887*

This study was approved by the Ethics Committee of Ankara Bilkent City Hospital (Date: 2022-10-26, No: E2-22-2660)